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ABSTRACT

This paper describes how the authors are exploiting the potential of interactive World Wide Web media to support a central part of academic life--the publishing, critiquing, and discussion of documents. The paper begins with an overview of documents in academic life and a discussion of paper-based or "papyrocentric" print and scholarly work. The following design principles, underlying the environment for reading and critiquing Web documents that the D3E (Digital Document Discourse Environment) Publisher's Toolkit generates, are summarized: (1) avoid over-elaborate discussion structuring schemes; (2) integrate document media with discourse; (3) redesign work practices to emphasize discourse; and (4) support the new practices with tools. The process of publishing and critiquing Web documents using D3E is described, and its application to an educational multimedia electronic journal and to tutors and students in a distance learning scenario is illustrated. Areas for future work are considered. Three figures present D3E screens, including a publication form, output from a source HTML file, and a shared discussion space. Contains 23 references. (MES)

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Document-Centred Discourse on the Web: A Publishing Tool for Students, Tutors and Researchers

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

ED 428 722

Abstract: This paper describes how we are exploiting the potential of interactive Web media to support a central part of academic life: the publishing, critiquing, and discussion of documents. We are as interested in supporting school and university students critiquing course texts and publishing their essays, as in professional scholars and researchers engaged in journal peer review and publishing. We question the replication of "papyrocentric" models which do not stop to question whether the new media make possible new forms of document and new modes of working. We then describe the design principles underpinning the environment for reading and critiquing Web documents that the D3E Publishing Toolkit generates, and illustrate its application to an educational multimedia e-journal, and to tutors and students in a distance learning scenario. We conclude by pointing to directions in which future work could develop.

Documents in Academic Life

The emergence of the internet, in particular the World Wide Web, have potentially far reaching implications for academic life, because *documents* mediate the work that students, tutors and researchers do everyday. This observation is at one level banal and not particularly helpful: documents mediate the established work practices of every organisation. However, taking this simple observation as a point of departure, a detailed understanding of the work that documents support, the contexts in which they are embedded, and the processes that give them their true significance in the communities that read and write them, opens up a spectrum of possible uses for new technologies (cf. [Brown & Duguid, 1996]).

In this paper, we use the term "publishing" in the broadest sense of a student, tutor or researcher making a document publically accessible, in this case, on the Web. Our approach to analysing how documents and publishing can change is best illustrated by examining what are arguably the central activities in academic life, namely, *publishing and critiquing documents*. The intellectual 'cut and thrust' of debate between peers as they contest the ideas in a document is a core skill that we seek to foster in students, and which obviously needs to be recognised and supported within professional scholarly communities. As members of these communities become increasingly distributed in time and space, how is this to be facilitated? In conventional teaching situations, such debate normally occurs amongst students when they are brought together in a moderated tutorial context; this is difficult in distance educational contexts. When the object of discussion is a document, we need more elegant environments than an e-mail list in order to easily refer to different parts of a document, and conduct parallel streams of discussion. In the context of a journal, such debate is also missing between authors, reviewers and peers with the exception of the few journals which publish commentaries and replies (albeit after a long delay, and with poor support for continued discussion following publication).

Our particular focus is therefore on *document-centred discourse*. In the following sections, we explain the design principles underlying *D3E (Digital Document Discourse Environment)*, and illustrate how it can support students, tutors and researchers in publishing and debating documents. We conclude by considering promising directions for future work.

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Paper-Based Print and Scholarly Work

From surveying the current state of the field, our conclusion is that most e-journals serve only to demonstrate the extent to which thinking is still "papyrocentric" (a term coined by Stevan Harnad). Traditional documents are simply disseminated digitally, and traditional activities are facilitated by established technologies such as e-mail and document/journal management systems. The central processes and products of scholarly work have gone unquestioned. This can be ascribed on the one hand to inertia amongst publishers who fear the loss of markets and are unsure of their role in digital publishing, and on the other to inertia in the paper-based academic culture, where traditional print literacy and genres dominate (understandably), literacy with new media (e.g. HTML, interactive and time-based media) is not yet widespread, and the pressure to publish in established journals is intense.

Papyrocentric deployment of interactive media does not seem to us, therefore, very imaginative. However, for the first time, the dominant influence of print on our conceptions of documents, publishing and associated scholarly processes is being seriously challenged by the convergence of the Web and communications tools. In such transitional times as these, constraints previously taken for granted are recognised as merely contingent on paper, and established modes of working are no longer as natural and obvious as they seemed. Such times provide the opportunity for radical and creative reflection on why we do what we do, offering the opportunity to keep the best properties of paper, but to explore alternative scenarios that transcend papyrocentric practices.

Design Principles Underpinning D3E

D3E is based on extensive research into how hypertext systems can support critical reflection and the analysis of arguments in writing and software design. Over a period of about six years, we have surveyed, prototyped and evaluated the usability and effectiveness of systems designed to support the representation and analysis of arguments to justify decisions, and the smooth switching of attention between building an 'artifact' (whether a written document, CAD design, or program), and reflection on it [Buckingham Shum, *et al.*, 1997][Sumner, *et al.*, 1997].

From this work on pre-Web hypermedia systems, we formulated several design principles to guide the development of D3E:

A: Avoid over-elaborate discussion structuring schemes.

B: Integrate document media with discourse.

C: Redesign work practices to emphasise discourse.

D: Support the new practices with tools.

Principle A: Avoid over-elaborate schemes for structuring comments and discussions. If users classify their document annotations or contributions to an online discussion, greater computer support can be provided. For instance, one can search for all *Theory* comments that have *Contradictory Evidence*, if those categories have been defined and used. Numerous schemes have been proposed for structuring discussions (e.g. [Conklin & Begeman, 1988][Turoff, *et al.*, 1991]. In the systems we have studied, discussion schemes have required users to categorise contributions as *issues*, *positions*, *comments*, *pros*, and *cons*. Schemes of this sort, however, run the risk of burdening people with excessive representational overhead by forcing them to categorise their ideas before they are ready to, or the scheme is too restricted to capture the nature of a subtle comment. Studies from a wide range of work contexts show that at least initially, users are often unable or unwilling to structure ideas in new ways, because the effort is too great for the perceived benefit [Shipman & McCall, 1994][Shipman & Marshall, 1994]. The answer is to allow a user community to evolve a richer scheme from a simple one as *they* deem it worthwhile (this may be in ways that cannot be predicted by an outsider).

Principle B: Computational tools must tightly integrate documents with comments and discussions about them. Many systems place documents in a different application to where discussions about them take place (we see this with e-mail discussion lists for Web e-journals). This separation hinders users from quickly accessing relevant comments when they are most needed and makes it hard to add contextualised comments. Likewise, tools should tightly integrate the textual parts of documents with any computational parts. Research in design support tools has shown that users need to easily bridge the separation between different representations of the design, and between representations and associated rationale [Fischer, *et al.*, 1991].

Principle C: Work practices must be redesigned so that structured annotations and discussions are integral to the task. Studies show that people often do not contribute to discussions because it is perceived as extra work

over and above what they are already required to do [Grudin, 1996]. Successful approaches have redesigned work practices to make contributing to a discussion integral to the overall task being performed [Terveen, *et al.*, 1993]. Others also advocate 'seeding' (providing some initial contents), arguing that people find it easier to contribute to a discussion site with content designed to promote debate, rather than starting from scratch [Fischer, *et al.*, 1994]. In a course setting, this means providing the right kind of motivation to students to participate in group debates, and seeding the discussion area with appropriate structures and questions. In a journal online peer review setting, this means redesigning the review process to *require* electronic threading of reviews into a shared space, changing the traditional roles of editor and reviewer, and seeding author-reviewer discussions for readers to build on.

Principle D: Tools are needed to support the new work practices. Many people may lack the technical skills, time, or inclination to engage in hand-crafting new digital document forms. Support is needed for automating the tedious and error-prone parts of the document creation process and to make it accessible to non-technical participants. Tools should be designed to make a good first approximation and then allow for humans to refine and correct the tools' output. The challenge is to create tools that are supportive, yet do not hinder the formation of new practices. Our goal is that the D3E Publisher's Toolkit will enable students, tutors and researchers (as well as professional publishers) to easily publish Web documents in a well-designed discussion environment, without having to worry about the intricacies of HTML.

Publishing and Critiquing Web Documents Using D3E

The D3E Project began through the design and publication of the *Journal of Interactive Media in Education* [JIME], which as we describe elsewhere [Sumner & Buckingham Shum, 1998] is a next generation e-journal that supports web-based peer review and interactive media embedded in articles. It became clear that the HTML mark-up effort that this involved had to be partially automated to make the publishing of such complex Web-sites tractable. It also became clear that there are many contexts where documents need to be discussed in different ways, by different populations. This motivated the requirements for a generic publishing toolkit which could be used to generate different kinds of document-centred discussion sites. The concept of a tailorable environment was conceived, with the project's research goals being to better understand the factors that make discussion and debate about media-rich Web documents intuitive and effective. We are concerned therefore with the whole spectrum of design issues, from Web hypermedia functionality and usability [Buckingham Shum & McKnight, 1997], to the computational, cognitive, and cultural issues that determine the uptake of such novel technologies by professional communities.

The D3E Publisher's Toolkit is the result, which generates an environment for reading and discussing Web documents. The toolkit provides a simple user interface via which the user (who does not need to know any HTML) fills in a form describing their document. First, one selects the style of publication to be generated (e.g. "Paper for student assignment") which determines the look and feel of the site, and then provides the relevant details of the document's title, author, etc. [Figure 1]. On hitting the "Go" button, the toolkit generates the HTML fileset for the environment whose key features are shown in [Figure 2]. The discussion environment is a tailored version of HyperNews [NCSA], but discussion structures in other Web-based systems could be generated. Figures 1 and 2 illustrate an article being published in JIME.

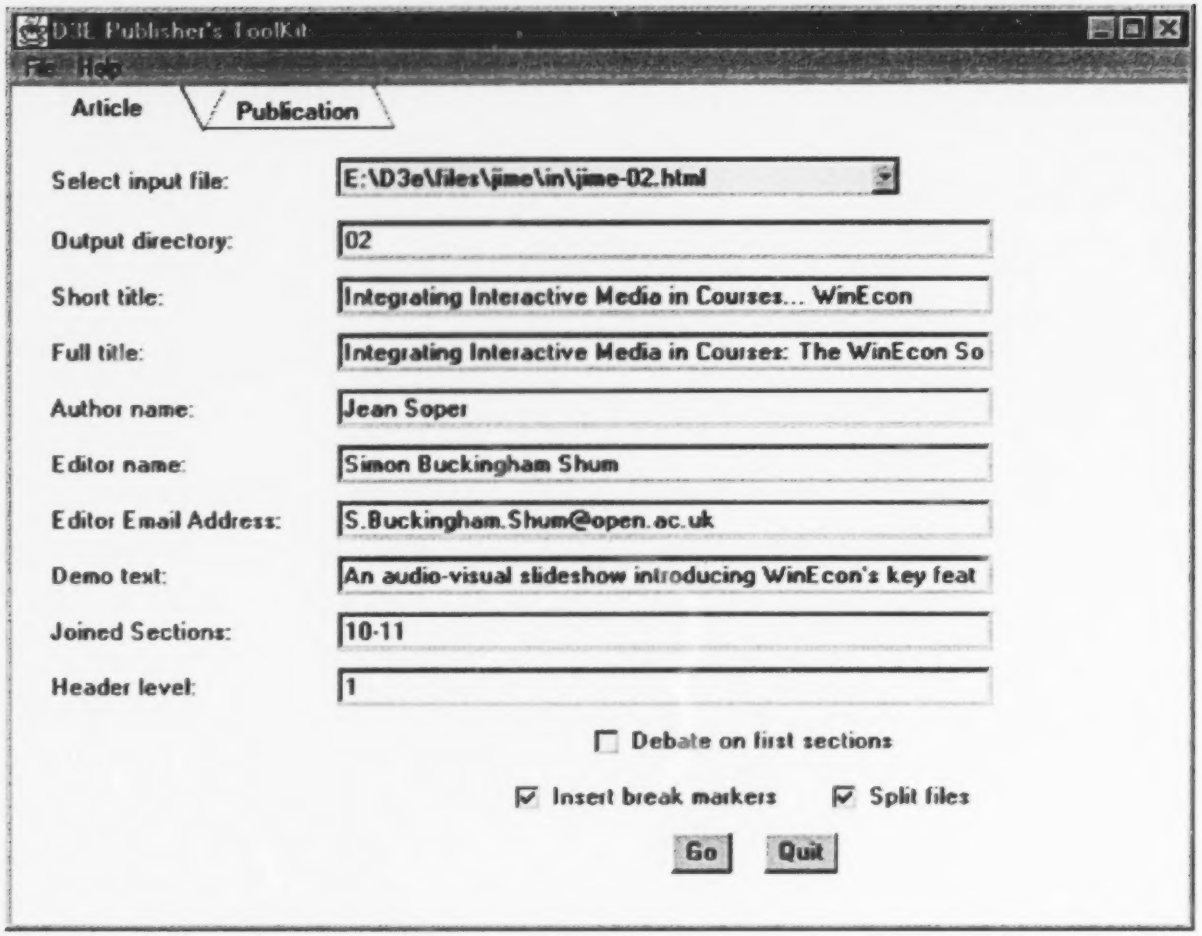

Figure 1: The D3E Publisher's Toolkit provides the tutor with a form to select the style of 'publication' (a student asignment), and a form for the article.

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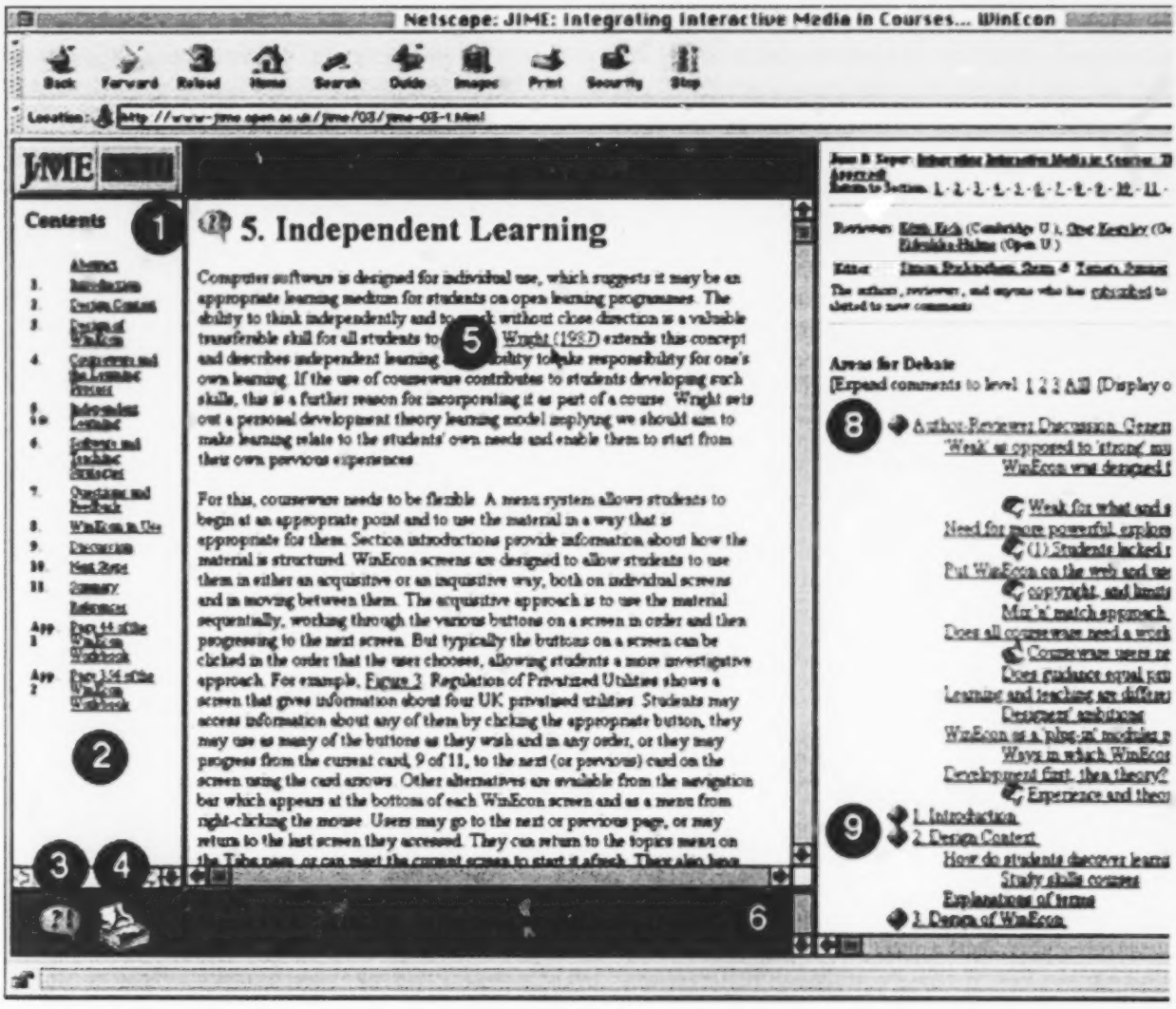
Netscape: JIME: Integrating Interactive Media in Courses... WinEcon
JIME
Contents
5. Independent Learning
Computer software is designed for individual use, which suggests it may be an appropriate learning medium for students on open learning programmes. The ability to think independently and to work without close direction is a valuable transferable skill for all students to
Wright (1987) extends this concept and describes independent learning
ability to take responsibility for one's own learning. If the use of courseware contributes to students developing such skills, this is a further reason for incorporating it as part of a course. Wright sets out a personal development theory learning model implying we should aim to make learning relate to the students' own needs and enable them to start from their own previous experiences.
For this, courseware needs to be flexible. A menu system allows students to begin at an appropriate point and to use the material in a way that is appropriate for them. Section introductions provide information about how the material is structured. WinEcon screens are designed to allow students to use them in either an acquisitive or an inquisitive way, both on individual screens and in moving between them. The acquisitive approach is to use the material sequentially, working through the various buttons on a screen in order and then progressing to the next screen. But typically the buttons on a screen can be clicked in the order that the user chooses, allowing students a more investigative approach. For example, Figure 2: Regulation of Privatized Utilities shows a screen that gives information about four UK privatised utilities. Students may access information about any of them by clicking the appropriate button, they may use as many of the buttons as they wish and in any order, or they may progress from the current card, 9 of 11, to the next (or previous) card on the screen using the card arrows. Other alternatives are available from the navigation bar which appears at the bottom of each WinEcon screen and as a menu from right-clicking the mouse. Users may go to the next or previous page, or may return to the last screen they accessed. They can return to the topics menu on the Tabs page, or can reset the current screen to start it afresh. They also have
Areas for Debate
[Expand comments to level 1 2 3 All] [Display o
Author-Reviewer Discussion: Genera
'Weak' as opposed to 'strong' ap
WinEcon was designed f
Weak for what and
Need for more powerful explora
(1) Students lacked
Put WinEcon on the web and use
copyright, and limita
Mix 'n' match approach
Does all courseware need a work
Courseware users ne
Does guidance equal pa
Learning and teaching are differe
Designers' ambitions
WinEcon as a 'plug-in' module a
Ways in which WinEcon
Development first, then theory?
Experience and theo
1. Introduction
2. Design Context
How do students discover learni
Study skills courses
Explanations of terms
3. Design of WinEcon
1
2
3
4
5
6
7
8
9

Figure 2: Output of the D3E toolkit from a source HTML file (example from JIME). On the left is the Article Window, on the right the Commentaries Window showing the outline view of discussion about the document. (The tiled-window interface for larger screens is shown; an overlapping window interface is provided for standard size displays).

A Student Assignment Scenario

An assignment on a distance learning course requires students to critique a conference paper which their tutor has placed on the course Web site. Students are required to construct a critique of it from a number of different perspectives. After the submission deadline, the tutor then allows everyone to see each others' critiques. In a follow-up exercise, the students and tutor discuss their

Key: **[1]** Comment icon embedded in each section heading: displays section-specific comments; **[2]** active contents list; **[3]** iconic link to display top level discussion outline, as shown on right; **[4]** iconic link to download Acrobat version; **[5]** citation is automatically linked to entry in references, displayed in footnote window; **[6]** reverse link to citation(s) in the text; **[7]** links from discussion back into article; **[8]** general heading (defined in toolkit) for discussion on the whole document; **[9]** headings for comments on specific sections of the document.

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different interpretations. The students then write a summary essay which they publish as a Web document with links back into the group discussions as evidence for their claims.

Let us imagine that the tutor has downloaded a paper from the Web and obtained clearance to use it for a teaching exercise. She has generated an interactive site from the toolkit, as described above. When a student logs in to the Web site, they are provided with a structured area with headings to guide the construction of their critique.

There are general headings which the tutor has defined as important issues to consider:

- Relationships to other articles in this module
- Does this adopt a modern or postmodern perspective?
- Summarise the article for a web designer in 100 words

These are followed by headings for each section in the article, under which section-specific comments can be made (see [Figure 2], points 8 and 9 to see how these are displayed).

After the submission deadline, all students are sent the address of the shared discussion space which has clustered each student's private annotations under the three discussion headings [Figure 3]. The students can now view and comment on each other's analyses in the second phase of the assignment. All of the students are automatically subscribed to this discussion, which means they are sent e-mail copies of new comments. They can also submit responses to the Website via e-mail, which students with slower Web connections find particularly useful (standard features of HyperNews). In the final stage, the students compose their summary essays. Most of them do this using their favourite wordprocessor, convert it to HTML, and then make the links to the relevant commentaries that they are using as evidence to back up their arguments.

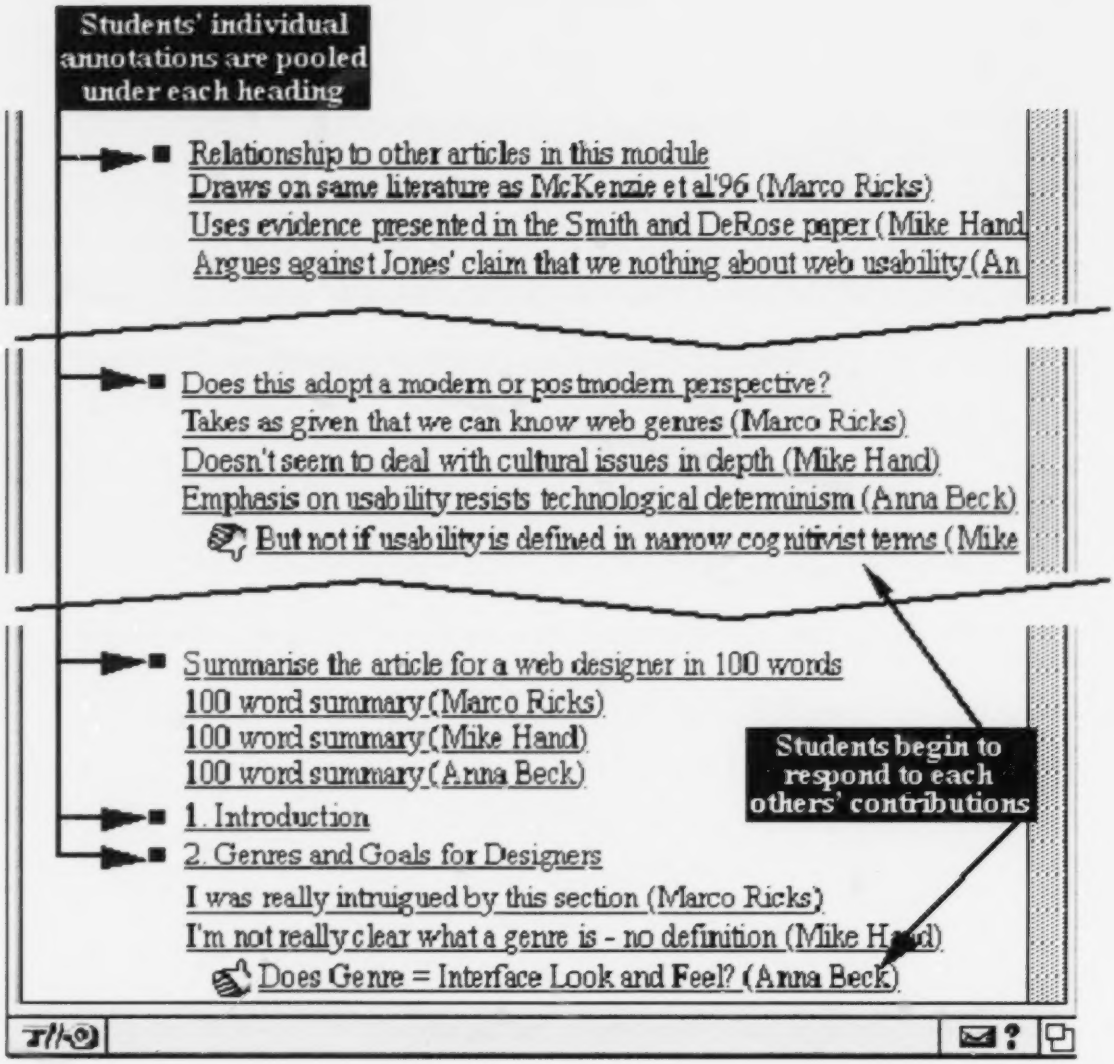
Students' individual annotations are pooled under each heading
Relationship to other articles in this module
Draws on same literature as McKenzie et al'96 (Marco Ricks)
Uses evidence presented in the Smith and DeRose paper (Mike Hand
Argues against Jones' claim that we nothing about web usability (An
Does this adopt a modern or postmodern perspective?
Takes as given that we can know web genres (Marco Ricks)
Doesn't seem to deal with cultural issues in depth (Mike Hand)
Emphasis on usability resists technological determinism (Anna Beck)
But not if usability is defined in narrow cognitivist terms (Mike
Summarise the article for a web designer in 100 words
100 word summary (Marco Ricks)
100 word summary (Mike Hand)
100 word summary (Anna Beck)
Students begin to respond to each others' contributions
1. Introduction
2. Genres and Goals for Designers
I was really intruigued by this section (Marco Ricks)
I'm not really clear what a genre is - no definition (Mike Hand)
Does Genre = Interface Look and Feel? (Anna Beck)

Figure 3: The shared discussion space where students can see and respond to each other's commentaries on the paper. Discussions are structured as threads, with the additional option of tagging a contributions as agreements ( ) or disagreements ( ).

Conclusion and Future Work

Given the ubiquity of document-centred work, D3E is also useful in contexts other than academic debate. We see supporting collaborative discussion of documents as important in the broader context of knowledge management in organisations, since documents acquire significance from the debate they provoke [Brown and Duguid, 1996]. D3E is being trialled within the Open University as a structured intranet environment for committee discussion documents. D3E has also been used to publish a national discussion Website to debate the recommendations of a government inquiry into the future of higher education [Dearing, 1997]. Comments and debate are organised on a recommendation-by-recommendation basis, to facilitate the pooling of related material in constructing responses to the inquiry. Elsewhere, we describe D3E's use to mediate discussion following a live webcast, in the build-up to a face-to-face conference [Sumner & Buckingham Shum, 1998].

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Future work will address our ability to analyse the usage of D3E generated sites in more detail, development of a client-server version of the toolkit (to help students publish their own documents such as essays, for discussion by peers), richer encoding of Web documents, and the emergence of new genres in scholarly publishing.

The latter two issues are related in an interesting way. It has been argued that in contrast to static, predominantly hierarchical documents, interactive hypertext networks make possible important new genres of writing [Landow, 1992][Kolb, 1997]. By extension, the Web could form the basis for new genres of scholarly writing and argumentation. In our own work, we are extending our analysis from support for discourse about a particular document (as D3E does at present), to support for interpretation of a document in relation to other work [Buckingham Shum & Sumner, 1997]. We are investigating the feasibility of enriching Web documents in ways that support searches for conceptually related documents. Approaches to this problem include HTML metadata [W3C, 1997], and shared, Web-accessible ontologies [Domingue, 1998]. Such a representational scheme could form the basis not only for more powerful Web searching, but for generating graphical views of the research literature [Chen, 1997], scientific argumentation, or concept maps [Gaines & Shaw, 1995].

To conclude, in the rapidly evolving world of the Web, it is a constant challenge to know how to use the technology effectively. We have argued for a strongly user-centred approach to understanding what we want the Web to do for us. We have described how we are interpreting the challenge of designing appropriate support for publishing and critiquing documents, a form of work that dominates academic life. We have summarised the design principles underpinning the environment for publishing, reading and critiquing Web documents that the D3E publishing toolkit generates, and illustrated its application to an educational multimedia e-journal, and for tutors and students in a distance learning scenario.

Acknowledgements

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